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FOR

Multiple Source Proxy Management System

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Multiple Source Proxy Management System

RELATED APPLICATIONS

This patent application is related to a patent application entitled "A Broadband Data Broadcasting Service", filed on April 16, 1999, having serial number 09/293,594.

FIELD OF THE INVENTION

The present invention relates to the field of proxy management. In particular the present invention discloses a proxy system that allows multiple sources of data to be accessed.

BACKGROUND OF THE INVENTION

The Internet has become a major source of news and information for very large numbers of people. In particular, millions of Internet users browse the World Wide Web (WWW) to obtain HyperText Markup Language (HTML) documents using the HyperText Transport Protocol (HTTP). Many people now receive more news and information from the Internet WWW sites than from traditional information sources such as television. The WWW portion of the Internet is an excellent medium for news and information since the WWW Internet sites can provide information to users on-demand. Specifically, Internet users can immediately request the exact information they are interested in when ever they wish from WWW Internet sites.

However, the use of the Internet WWW as a news distribution does suffer from a number of deficiencies. One serious problem is that the limited bandwidth of most Internet connections severely limits the amount of information delivered. Most Internet users access the Internet through a telephone-based dial-up modem at speeds of 56kps per second or less. With such limited bandwidth available, most Internet based WWW sites only deliver text and static images. When video information delivered through 56K Internet connections, the video information is compressed so heavily such that only small low-resolution video images are delivered at a low frame rate. For users that are more familiar to broadcast quality television video, highly compressed Internet distributed video is not worth viewing unless the content is extremely desirable.

To improve upon the performance of the Internet, many telecommunication providers are now offering high-bandwidth connections for the "last mile" to an Internet user's residence. Cable television providers are now offering cable modem Internet service that use cable television wiring to deliver broadband Internet service. Similarly, telephone companies are rolling out Digital Subscriber Line (DSL) services that provide broadband Internet service. Although these broadband data connections provide additional bandwidth, such broadband connections only address the "last mile" bandwidth problem associated with sending rich multi-media information across the Internet. Many other problems will continue to exist. For example, the point-to-point nature of Internet communication limits large-scale video deliver. Most Internet communication occurs in a unicast manner wherein a unique communication connection is established between each information server and each Internet client. Since each Internet client requires its own connection, the bandwidth requirement for serving

information grows linearly with the number of Internet clients being served. Furthermore, each Internet client that requests service adds additional load to the server systems that service information. To serve rich multimedia information to a large number of client systems, a large powerful server farm is required. It is therefore quite expensive from the server end in both communication costs and computer costs to serve large amounts of rich multi-media information.

Due to the above-described problems associated with Internet delivery of multimedia information, additional data deliver systems are being developed. An example of another data delivery system can be found in the patent application entitled "A Broadband Data Broadcasting Service", filed on April 16, 1999, having serial number 09/293,594. Although such systems provide highly desirable features, the Internet will still remain an interesting medium. It would therefore be desirable to provide a multi-media rich information system that is similar to the Internet in terms of on-demand access of interesting information but without the bandwidth problems associated with the Internet network system.

SUMMARY OF THE INVENTION

The present invention discloses a proxy management system that allows a browser program to access multiple different data services using a personal proxy server. The personal proxy server accesses the browser program's Internet settings to determine the current environment. The personal proxy server stores those settings so that they may be restored at a later time. The personal proxy server then changes the browser program's Internet settings such that the browser program directs future requests to the personal proxy program. The personal proxy program then accepts requests from the browser program. When the personal proxy program receives a request, the personal proxy program examines the request and selects an appropriate handler. The personal proxy program then directs the request to the appropriate handler. The appropriate handlers may include the originally specified Internet settings, a local cache program, a data appliance peripheral, or any other data service.

Other objects, features, and advantages of present invention will be apparent from the company drawings and from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects, features, and advantages of the present invention will be apparent to one skilled in the art, in view of the following detailed description in which:

Figure 1A illustrates a computer system coupled directly to the Internet.

Figure 1B illustrates a computer system coupled to the Internet through a packet filtering firewall.

Figure 1C illustrates a computer system indirectly coupled to the Internet through a proxying firewall.

Figure 2A illustrates a computer system coupled to a broadcast data service and the global Internet.

Figure 2B illustrates a set-top box system coupled to a broadcast data service and the global Internet.

Figure 3 illustrates a conceptual document of one possible embodiment of a data broadcast receiver system.

Figure 4 illustrates a block diagram of a personal computer system that uses a single browser system to communicate with several data sources using a personal proxy server.

Figure 5 illustrates a block diagram of a personal computer system that uses a personal proxy server to communicate with the Internet through a proxying firewall.

Figure 6 illustrates a flow diagram that describes the operation of a personal proxy server.

Figure 7 illustrates a block diagram of a personal computer system that uses a personal proxy server to communicate with the Internet through a proxying firewall that uses an autoconfig file.

Figure 8 illustrates a flow diagram that describes the operation of a personal proxy server that communicates with a proxying firewall that uses an autoconfig file.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A proxy management system is disclosed. In the following description, for purposes of explanation, specific nomenclature is set forth to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that these specific details are not required in order to practice the present invention. For example, the present invention has been described with reference to a wireless datacasting service that is cached on a local device. However, the same proxying techniques can easily be applied to other types of data communication systems.

Overview Internet Proxy Systems

There are a number of different ways of connecting a personal computer system to the global Internet. Each different method has its own advantages and disadvantages.

Direct Internet Connections

Figure 1A illustrates a conceptual diagram of a personal computer system **110** that has a "direct" connection to the global Internet **101**. The connection is made using some type of Internet connection system **120**. Most residential personal computers currently use a dial-up modem that connects to a remote access device at an Internet Service Provider (ISP) as an Internet connection device **120**. In a quest for a faster Internet connection, many residential customers are now beginning to use "broadband" Internet connection systems that provider faster data throughput with lower latency. Examples of broadband Internet connection systems **120** include Digital Subscriber Line

(DSL) and cable modem connections to an ISP. In a direct Internet connection, the end personal computer system **110** uses a "legal" external Internet Protocol (IP) address that is routable. While the personal computer system is coupled to the Internet, the personal computer system **110** "owns" that unique IP address.

Indirect Internet Connections

To protect computers from Internet attacks and conserve address space, many personal computer systems are coupled to the Internet using some type of indirect Internet connection. **Figures 1B** and **1C** illustrate two different examples of indirect Internet connections.

In the indirect Internet connection embodiment of **Figure 1B**, a packet filtering firewall **130** shields a personal computer **113** from the Internet. In such an embodiment, it is the packet filtering firewall **130** that is coupled to the Internet **101** through some type of Internet connection system **123** such as a dial-up modem, a DSL modem, a leased line, or other Internet connection. The packet filtering firewall **130** filters all the packets passing between the personal computer **113** and the Internet **101**. If the packet filtering firewall **130** deems that a particular packet may be malicious, then the packet filtering firewall **130** will drop that packet. Thus, the personal computer system does communicate with entities on the global Internet, but only under the strict supervision of the packet filtering firewall **130**. A packet filtering firewall **130** may also perform network address translation. Network transaction allows a firewall device to share one (or more) legal IP addresses among a number of systems on an internal network that uses non-routable IP addresses such as Net 10 addresses. (Net 10 addresses are IP

addresses in the form of 10.0.0.1 to 10.255.255.255 since that address range has been designated as non-routable.)

In the indirect Internet connection embodiment of **Figure 1C**, a proxying firewall **140** shields a personal computer **117** from the Internet **101**. In such a proxying embodiment, only the proxying server **140** is coupled to the Internet **101** through some type of Internet connection system **127**. In a proxying type of indirect Internet connection, the personal computer system **117** does not communicate directly with any entity on the Internet **101**. Instead, the personal computer system **117** only communicates with the proxying firewall **140**. The proxying firewall **140** examines requests for Internet content and may decide to drop requests, fulfill requests using locally cached information, relay the requests to the addressed entity on the Internet, or handle the request in another manner.

Overview of A Data Broadcast System

The present invention integrates the various direct and indirect Internet communication systems of **Figure s1A**, **1B**, and **1C** with another data service. In one disclosed embodiment, a wireless data broadcast system is integrated with the Internet. However, the teachings of the present invention may be used with other types of data services.

Figure 2A illustrates a first example usage of a wireless data service used by a personal computer system **210**. In **Figure 2A**, a wireless multimedia receiver/server device **230** receives data broadcasts received through some data broadcast channel. The

data broadcast channel may comprise terrestrial radio broadcasts, satellite broadcasts, cable broadcasts (such as cable TV), or any other broadcast media. In the embodiment of **Figure 2A**, a personal computer system **210** is coupled directly to the wireless multimedia receiver/server device **230** to receive data from that device. A number of different interface systems such as an Ethernet interface, a FireWire™ Bus (IEEE.1394), or a Universal Serial Bus (USB) interface may couple computer system **210** to wireless multimedia receiver/server device **230**. The personal computer system **210** may also be connected to the global Internet **201** through some type of Internet connection **220** to receive Internet based information.

The wireless multimedia receiver/server device is not limited to usage by personal computer systems. **Figure 2B** illustrates an example usage wherein a television set-top box **270** is coupled to a wireless multimedia receiver/server device **250**. The television set-top box **270** may also be connected to the global Internet **201** through some type of Internet connection **260** to receive Internet based information.

A Data Broadcast Receiver System

Figure 3 illustrates a conceptual diagram of one possible embodiment of a data broadcast receiver system **300**. Referring to the conceptual diagram of **Figure 3**, a packet extraction and processing system **310** examines a multiplexed digital information stream received using the receiver system **301**. The packet extraction and processing system **310** extracts network packets that may be of interest to the data broadcast receiver/server system **300**. Specifically, the packet processing system **310** identifies and extracts packets that are specifically addressed to the data broadcast receiver/server system **300** and packets that have specific defined characteristics.

The extracted packets are passed to a packet routing system **330**. The packet routing system **330** routes the received packets appropriate destinations. The packet routing system **330** may route other data packets to client system **399** coupled to the multimedia receiver/server system **300** through computer interface **390**. In such operations, the multimedia receiver/server system **300** acts as a packet router to deliver packets broadcast over a broadcast medium.

The data broadcast receiver/server system **300** may also be used to provide useful data services by locally caching information. Specifically, one or more caching applications **345** receive data packets from the packet routing system **330** and caches information from those packets into a file system **350**. In one embodiment, the caching application **345** may request to receive packets addressed to one or more designated addresses that carry multimedia information and accompanying descriptors. The caching application **345** selectively captures multimedia information and stores that multimedia content information **353** in a file system **350**. The caching application **345** may create multimedia information directory **355** such that the cached multimedia information may be quickly searched and accessed. The multimedia information may consist of anything that can be expressed in digital form including audio, video, text, web pages, and computer programs.

The data broadcast receiver/server system **300** may present the cached multimedia information in a number of different ways. However, one of the most popular current methods of presenting information is in the form of World Wide Web (WWW) pages formatted in HyperText Markup Language (HTML) or eXtensible Markup

Language (XML). One embodiment of the data broadcast receiver/server system **300** uses a web page constructing application **360** to create WWW pages **359** that may be presented to the client system **399**. A web server application **381** serves the created web pages **359** to client systems that request the web pages **359**. Due to the caching of rich multimedia information, the web server 3**781** may be aided by one or more file streaming applications **382** and **383**. The file streaming applications **382** and **383** may stream rich multimedia information such as videos and audio.

The data broadcast receiver/server system **300** of **Figure 3** is only meant to provide one possible embodiment of a data broadcast system. Additional information on a data broadcast system can be found in the U.S. patent application entitled "A Broadband Data Broadcasting Service", filed on April 16, 1999, having serial number 09/293,594. Furthermore, other types of data services may be provided.

Personal Proxy Server

As illustrated in **Figure 2A** and **2B**, two different data services (the Internet **201** and a data broadcast service) may be provided to a single client computer system. In other embodiments (not shown) more than two different data services may be coupled to a single client computer system. Each different data service may provide different types of information and different sources of information. One method of allowing a user of the client computer system to access the different data services would be to have a different client program on the client computer system for each different data service. In such an embodiment, each client program could have special features that address specific characteristics of each data service. However, such an embodiment

would require the user to learn a different user interface for each type of data service. Furthermore, the user would have to maintain all the different client programs for each data service. Thus, it would be desirable to have a unified system of accessing different data services.

The present invention introduces a method of allowing a common Internet browser program be used to access multiple different data services. Specifically, the present invention introduces a "personal proxy server." The personal proxy server responds to requests from an Internet browser and then handles those requests using an appropriated data service. **Figure 4** illustrates a first embodiment of a personal proxy server **420**.

Referring to **Figure 4**, an Internet browser **410** runs on a computer system **400**. The Internet browser **410** may be Netscape's Navigator, Microsoft's Internet Explorer, or any other suitable Internet browser program. The Internet browser **410** is configured to access the Internet using a proxy server wherein the proxy server is specified as the personal proxy server **420**. The personal proxy server **420** is actually a program that runs on the computer system **400**. In such a configuration, the Internet browser **410** will communicate with the personal proxy server **420** whenever the Internet browser **410** has a data request. The personal proxy server **420** is thus responsible for properly handling all communication from the Internet browser **410**.

In the embodiment of **Figure 4**, the personal proxy server **420** has access to two different data services. Specifically, the personal proxy server **420** may access the Internet **401** using network drivers **427** through an Internet connection **450** or the personal

proxy server **420** may access a data broadcast service through data appliance drivers **425** that communicate with a data broadcast receiver system **430**. When the personal proxy server **420** receives a request from the Internet browser **410** the personal proxy server **420** must first decide which data service will respond to the request. The personal proxy server **420** then consults with the selected data service to handle the request. One method of determine which data service to use is to examine the Uniform Resource Locator (URL) of the request for specific patterns. For example, the personal proxy server **420** may direct all URLs containing the Internet domain name "AcmeDataBroadcast.com" toward the data broadcast receiver system **430**.

Once the personal proxy server **420** has determined which data service to handle a particular request, the personal proxy server **420** may simply relay the request on to the proper data service. For example, if the personal proxy server **420** receives an HTTP "GET" request for an Internet site, the personal proxy server **420** may simply pass the HTTP "Get" request to the Internet service using the Internet connection.

It should be emphasized that the personal proxy server **420** can handle many different data services. Furthermore, other types of data systems may be provided. For example, **Figure 4** further includes a local cache driver **429** that may be used to handle certain requests.

Integration With Existing Proxy Servers

As previously set forth with references to **Figures 1A**, **1B**, and **1C**, there are many different ways to connect a computer system to the global Internet. As

illustrated in **Figure 1A**, many computers are coupled directly to the Internet. However, computers are increasingly coupled to the Internet using an indirect connection as shown in **Figures 1B** and **1C**. To adequately hand consumer expectations, the personal proxy server must be able to handle many different types of Internet connections.

Direct Internet, packet filtering routers, or Simple Proxy Firewall Connections

Figure 5 illustrates a computer system **500** that uses a personal proxy server **520** to service an Internet browser **510**. The personal proxy server **520** must direct requests from the Internet browser **510** to a local cache **529**, a data broadcast service on data broadcast receiver **530**, or the global Internet **501** via a proxy server **550**. Since the Internet **501** is only accessible via the proxy server **550**, the personal proxy server **520** must use the proxy server **550** appropriately.

Figure 6 illustrates a flow diagram that describes how the personal proxy server **520** may operate in an environment with a direct Internet connection, a packet filtering firewall, or the simple proxying firewall as illustrated in **Figure 5**. Referring to step **610**, the personal proxy server **520** first reads the original Internet settings of the Internet browser **510**. Next, the personal proxy server **520** stores the original Internet settings at step **620**. The personal proxy server **520** stores the setting so that (1) the personal proxy server **520** will know how to access the Internet; and (2) the personal proxy server **520** will be able to replace the original Internet settings if the personal proxy server **520** is uninstalled.

At step **630**, the personal proxy server **520** changes the Internet settings of the Internet browser **510** such that the Internet browser **510** will access the personal proxy

server **520** for future requests. Specifically, the personal proxy server **520** instructs the Internet browser **510** to access the personal proxy server **520** as proxy server for all future requests of designated types. In one embodiment, the personal proxy server **520** only handles HyperText Transport Protocol (HTTP) requests.

After setting the Internet browser's settings, the personal proxy server **520** is ready to accept requests at step **640**. When the personal proxy server **520** receives a request, the personal proxy server **520** determines the appropriated handler to handle the request at step **650**. As previously set forth, the personal proxy server **520** may determine the proper handler by examining the URL in the request. After determining the proper handler, the personal proxy server **520** directs the request to the proper handler at step **660**.

If the appropriate handler is the local cache or data broadcast service, then the personal proxy server **520** proceeds to steps **690** or **680**, respectively, to handle the request. If the Internet should handle the received request, then the personal proxy server **520** proceeds to step **670** where it uses the stored Internet settings. If the stored Internet settings indicate a direct connection, then the request is relayed onto the Internet. If the stored Internet settings indicate a proxy server connection, then the personal proxy server **520** communicates with the Internet through the specified proxy connection. In such an environment, there is a double layer proxy.

<u>AutoConfig Proxy Firewall Connections</u>

Certain firewalls implement a sophisticated proxying system known as an autoconfig proxy. An autoconfig proxy system uses a file that automatically configures the client system. In an environment that uses an autoconfig proxy, each client system is

informed where the autoconfig file may be found. Each client fetches that autoconfig file and uses that autoconfig file to determine how browser requests should be handled. In many embodiments, the autoconfig file contains a short JavaScript program that contains a function FindProxyForURL() that returns an access method for a particular protocol.

Figure 7 illustrates an example of a network environment with an autoconfig proxy server system. Referring to **Figure 7**, a proxy server **750** connects a network **741** to the Internet **701**. The proxy server **750** has an autoconfig file **753** that specifies how to use the proxy server **750**. (Note that the autoconfig filed **753** does not need to be stored on the proxy server **750** but it must be accessible by all the clients on the network **741**.) Each client system on the network **741**, such as computer system **700**, must fetch the autoconfig file **753** in order to learn how to access the Internet **701** via the proxy server **750**.

Figure 8 illustrates how a personal proxy server **720** implemented according to the teachings of the present invention operates in an autoconfig proxy environment. Referring to step **810**, the personal proxy server **720** first reads the original Internet settings of the Internet browser **710**. Next, the personal proxy server **720** stores the original Internet settings at step **820**. At step **830**, the personal proxy server **720** determines if the Internet settings specify an autoconfig proxy. If the settings specify an autoconfig proxy, then personal proxy server **720** proceeds to step **834** where it obtains the autoconfig file and stores a copy of that original autoconfig file. Next, at step **836**, the personal proxy server **720** modifies the autoconfig file. Specifically, the personal proxy server alters the autoconfig file such that the personal proxy server **720** will be accessed if an HTTP request is made.

To fully describe how the personal proxy server **720** modifies an autoconfig rile, an example will be provided. A sample autoconfig file may contain the following JavaScript code:

```
/*
 * HTTP traffic uses proxy1, FTP traffic uses proxy2
 * All other protocols directly connect.
 */

function FindProxyForURL(url, hostname)
{
   if (shExpMatch(url, "http:*")) {
      return "PROXY proxy1:1234";
   } else if (shExpMatch(url, "ftp:*")) {
return "PROXY proxy2:1235";
   }
   return "DIRECT";
}
```

The personal proxy server **720** modifies an autoconfig file by renaming an original "FindProxyForURL" procedure and replacing it with a revised FindProxyForURL that directs http requests to the personal proxy server **720** that monitors TCP port 1166. The modified autoconfig file is shown below:

```
/*
 * HTTP traffic uses proxy1, FTP traffic uses proxy2
 * All other protocols directly connect.
 */

function FindProxyForGeo(url, hostname)
{
   if (shExpMatch(url, "http:*")) {
      return "PROXY proxy1:1234";
   } else if (shExpMatch(url, "ftp:*")) {
return "PROXY proxy2:1235";
   }
   return "DIRECT";
}

/* Geocast added body */
```

```
function FindProxyForURL(url, host)
{
  res = FindProxyForGeo(url, host);
  if (shExpMatch(url, "http:*")) {
    return "PROXY localhost:1166; " + res;
   /* Person Proxy Program responds to requests at port 1166 */
  }
  return res;
}
```

After modifying the autoconfig file (if there was one), the personal proxy server **720** sets the Internet browsers settings to access the personal proxy server **720**. If the original settings specified an autoconfig file, then the personal proxy server **720** specifies that the Internet browser **710** should access the personal proxy server **720** to obtain an autoconfig file. When the Internet browser subsequently requests the autoconfig file, the personal proxy server **720** supplies the modified autoconfig file. The Internet browser **710** will use the supplied autoconfig file to determine how requests should be handled. Certain requests will be directed to the personal proxy server **720**.

After setting the Internet browser's settings, the personal proxy server **720** is ready to accept requests at step **850**. When the personal proxy server **720** receives a request, the personal proxy server **720** determines the appropriated handler to handle the request at step **860**. As previously set forth, the personal proxy server **720** may determine the proper handler by examining the URL in the request. After determining the proper handler, the personal proxy server **720** directs the request to the proper handler at step **870**. If the appropriate handler is the local cache or data broadcast service, then the personal proxy server **720** proceeds to steps **887** or **883**, respectively, to handle the request.

If the Internet should handle the received request, then the personal proxy server **720** proceeds to step **890** where the personal proxy server **720** runs the original autoconfig file. The personal proxy server **720** then uses the results from that original autoconfig file to handle the requests as specified in step **895**.

The foregoing has described a multiple source proxy management system. It is contemplated that changes and modifications may be made by one of ordinary skill in the art, to the materials and arrangements of elements of the present invention without departing from the scope of the invention.